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REPORT NO. 91-R-03
AFPEA PROJ. NO. 88-P-108

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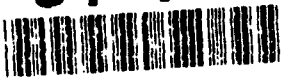
QUALIFICATION TESTING OF VARIOUS FASTENING DEVICES ON WOOD BOXES

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AFB OH 45433-5999

OCT 1991



NOTICE

ABSTRACT

In April 1988, the Air Force Packaging Evaluation Activity (AFPEA) initiated this project in order to find a better method of fastening the cover to the base of the MIL-B-26195 wooden box design in order to make the containers more reusable. The present design requires that new holes be drilled for the placement of the lag bolts after the container has been disassembled and reassembled several times.

Three boxes were constructed and tested at the AFPEA, HQ AFLC/LGTPD, Wright Patterson AFB, OH 45433-5999. Box number one utilized the present method of lag bolts into the skids as a control. Box number two consisted of bolts and blind nuts as the cover to base fasteners. Box number three used drywall screws as the fasteners.

The test plan was developed to evaluate how well the cover held to the base. The tests were conducted in accordance with Federal Test Method Standard 101C.

Results of the tests conducted on the prototypes show that bolts and blind nuts provided better fastening and nearly indefinite reusability.

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INTRODUCTION

BACKGROUND: The Air Force Packaging Evaluation Activity (AFPEA) initiated this project to find a better method of fastening the cover to the base of the PPP-B-601H wooden box design as a result of problems encountered in the field.

PURPOSE: The purpose of this project was to design a method of fastening the cover to the base of the MIL-B-26195 wooden box that was more reusable than the present method of lag bolts.

DESCRIPTION OF TEST CONTAINERS

One container, using the present method of lag bolts, was constructed as a control. Two other containers were made with two different types of cover to base fasteners. The corners of each of the three containers were numbered counterclockwise from the front right-side corner as shown in figure 1.

Design: Box no. 1 (control) used ten of the standard 3" X 3/8" lag bolts. Box no. 2 used ten sets of 4 1/2" X 3/8" bolts and 3/8" blind nuts. Box no. 3 used eighteen 2" drywall screws. All hardware was obtained off the shelf from a hardware store.

Construction: All containers were 36" X 26" X 33" built in accordance with PPP-B-601H and MIL-B-26195C style A.

TEST OUTLINE AND TEST EQUIPMENT

Test Plan: Tests were conducted in accordance with AFPEA Test Plan 88-P-108 (see attachment 1). The tests were developed to evaluate the structural integrity of the container with the new fasteners. Test methods, procedures and pass/fail criteria were in accordance with Federal Test Method Standard 101 (FTMS101C).

Test Load: All tests, except the superimposed load test, were conducted using a 1000 pound lead dummy load which was constructed at the AFPEA (see figure 2).

Test Site: All testing was conducted at the AFPEA, HQ AFLC/LGTPD, Building 70, Area C, Wright-Patterson AFB OH 45433-5999. The equipment required for each test is noted in the test plan.

TEST PROCEDURES AND RESULTS

Edgewise-Drop Test

Test No. 1: The edgewise-drop (rotational) test was performed in accordance with Method 5008.1. The drop height was 16" (see figure 3).

Results: Visual inspection revealed no damage to any of the containers.

Cornerwise-Drop Test

Test No. 2: The cornerwise-drop (rotational) test was performed in accordance with Method 5005.1. The drop height was 16" (see figure 4).

Results: Visual inspection revealed no damage to containers 1 and 2. On the second drop, container 3 failed. The skid pulled away from the cover section. After disassembly, it was found that all screws holding the cover to the base, except those on side 2-3, had been sheared off. One screw on side 1-4 was badly bent but not broken. This is because a chunk of wood from the end header had broken off before the screw could break (see figure 5). Due to this failure, no further testing will be done on container 3.

Superimposed Load Test

Test No. 3: The ambient superimposed load test was conducted in accordance with Method 5016.1. A load of 10,500 pounds was placed on top of a fully assembled container using a loaded base of another container, simulating a stack of containers 16 feet high with a safety factor of two (see figure 6).

Results: Visual inspection revealed no damage to containers 1 and 2.

Repetitive Shock

Test No. 4: The repetitive shock test was conducted in accordance with Method 5019.1. The containers were placed separately on the shaker table and blocked in with 1/2" spacing on all sides (see figure 7). A 1/16" vertical bounce was applied at 4.5 Hz with 1" double amplitude for two hours.

Results: Visual inspection revealed no damage to containers 1 and 2. All the fasteners on container 2 were still in place and tight. Four of the ten bolts in container 1 were loose as a result of the testing.

CONCLUSION

Containers no. 1 and no. 2 gave the same results when tested in accordance with the container test plan. As expected, some of the holes in container 1 were so worn out from the assembly and disassembly that new holes would need to be drilled for continued use of that container. Container no. 2 would never need to have the holes re-done. The drywall screws on container 3 were too weak to be acceptable due to the failure during the second drop test and it is also not probable that an increase in the number of screws would sufficiently improve this design.

RECOMMENDATIONS

It is recommended to use blind nut fasteners because of their reusability. An adhesive to hold the blind nuts in place permanently would be beneficial. If too much force is used when pushing the bolts through to the blind nuts, the nuts may be knocked out.

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-108

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
33x24x26	36x26x33	1083	1000	17.7	3	11 Sep 91

ITEM NAME: Lead Dummy Load

MANUFACTURER:

CONTAINER NAME: MIL-B-26195C Lag Bolt Test

CONTAINER COST:

PACK DESCRIPTION: Wooden Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	EDGEWISE DROP FED-STD-101C METHOD 5008.1	Container shall be dropped once on each bottom edge from a height of 16" for a total of 4 drops.	One edge shall rest on a 6" block.	Forklift or hoist
2.	CORNERWISE DROP FED-STD-101C Method 5005.1	Container shall be dropped once on each bottom corner from a height of 16" for a total of 4 drops.	One corner shall rest on a 6" block, the adjacent corner shall rest on a 12" block.	Forklift or hoist

COMMENTS:

PREPARED BY: JASON GILREATH, Engineer Trainee

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

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CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
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CONTAINER COST:

PACK DESCRIPTION: Wooden Container

CONDITIONING: As noted below

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
3.	SUPERIMPOSED LOAD FED-STD-101C METHOD 5016.1	Stack loaded base of one container onto another fully assmbled container. Leave stacked for 1 hour. Weight=Px(16-H)/HxS =1083x(16-2.75)/ 2.75x2 where P=weight of loaded container (lbs) H=height of container (ft) S=safety factor for level A packing	Bottom container is being tested. Test conducted at ambient temperature.	Record changes, i.e. buckling deforma-tions
4.	REPETITIVE SHOCK FED-STD-101C Method 5019.1	Test using vertical motion for two hours at 1 ±.1 G or 1/16" bounce between 3 to 5 Hz. Mount restraining blocks 1/2" away from sides of container	Ambient	

COMMENTS:

PREPARED BY: JASON GILREATH, Engineer Trainee

APPROVED BY: TED HINDS, Chief, Design Br., AFPEA

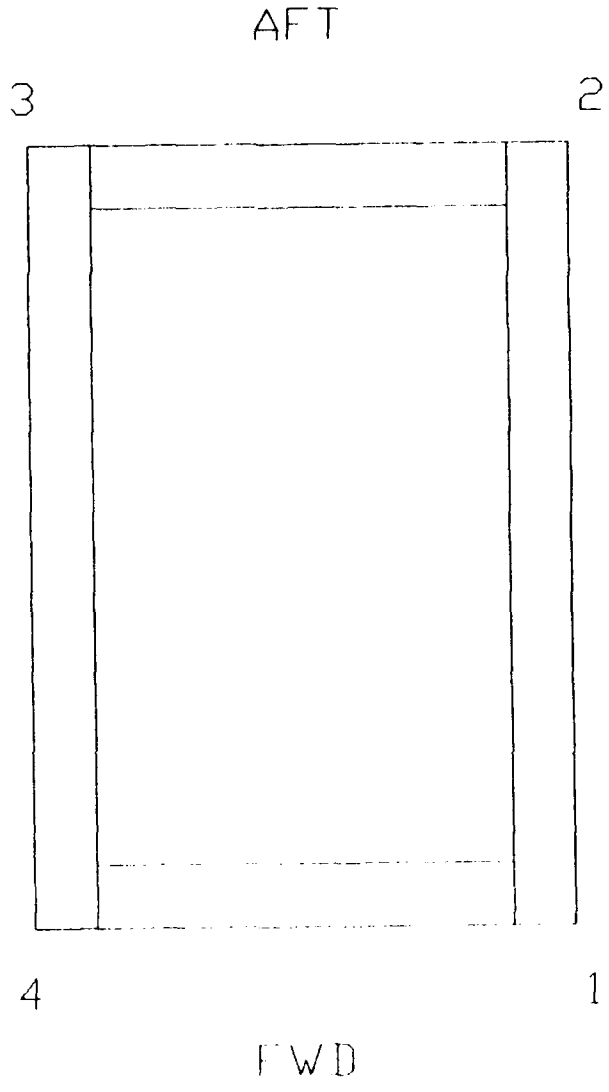

FIGURE 1. Corner Numbering

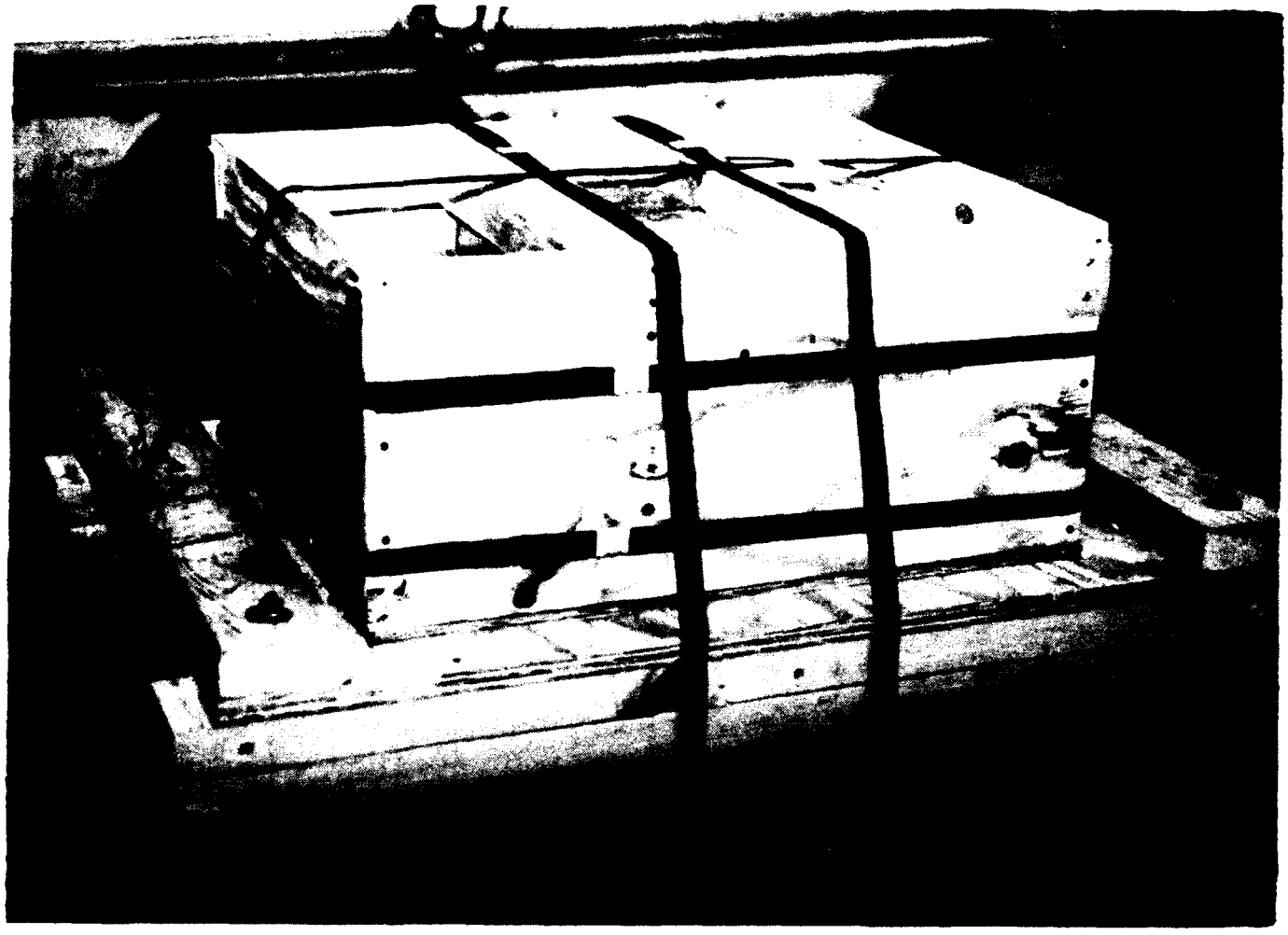

Figure 2: 1000 Pound Lead Dummy Load

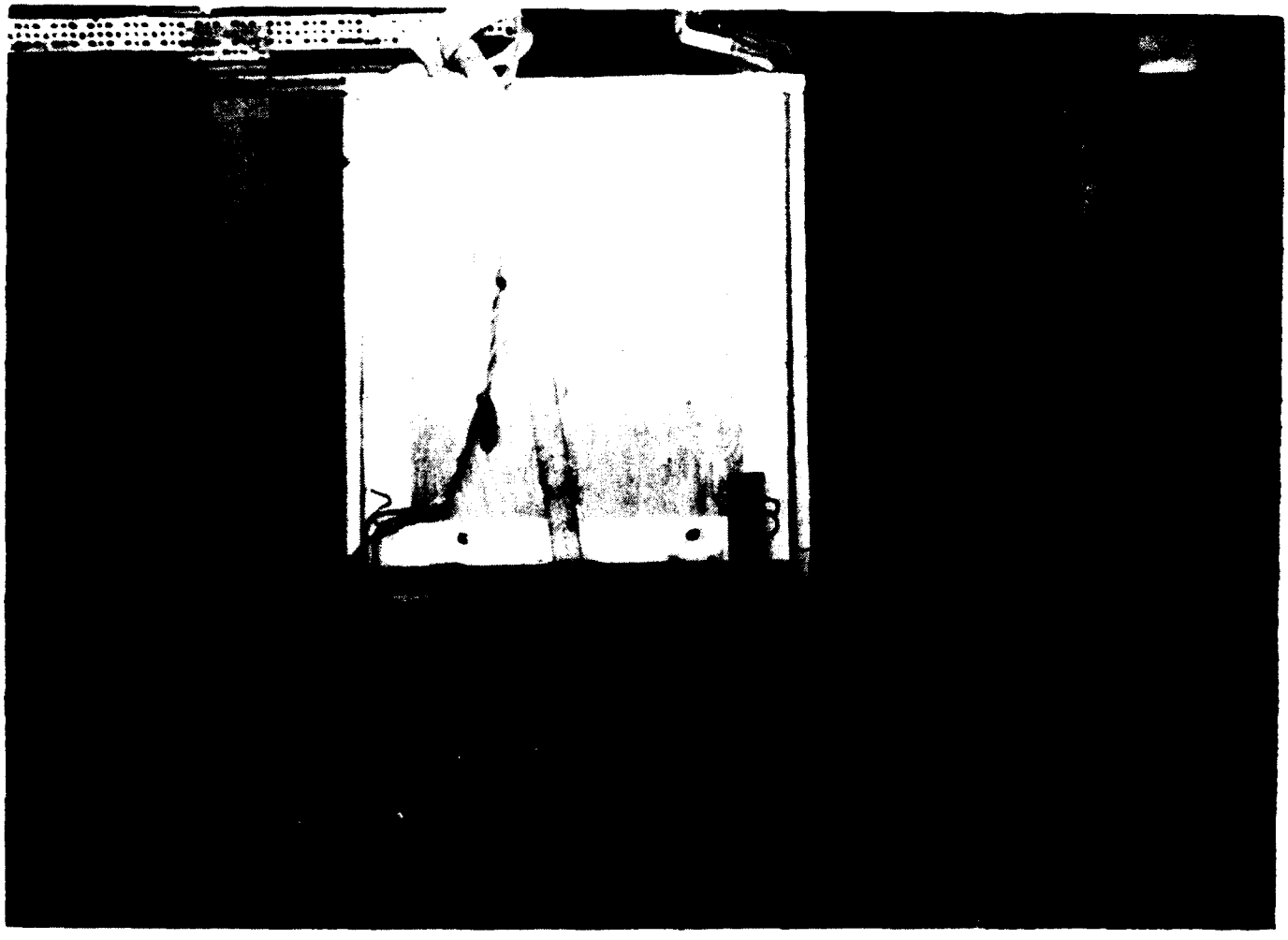

Figure 3: Edgewise Drop - 16 inches
FTMS101C - Method 5008.1

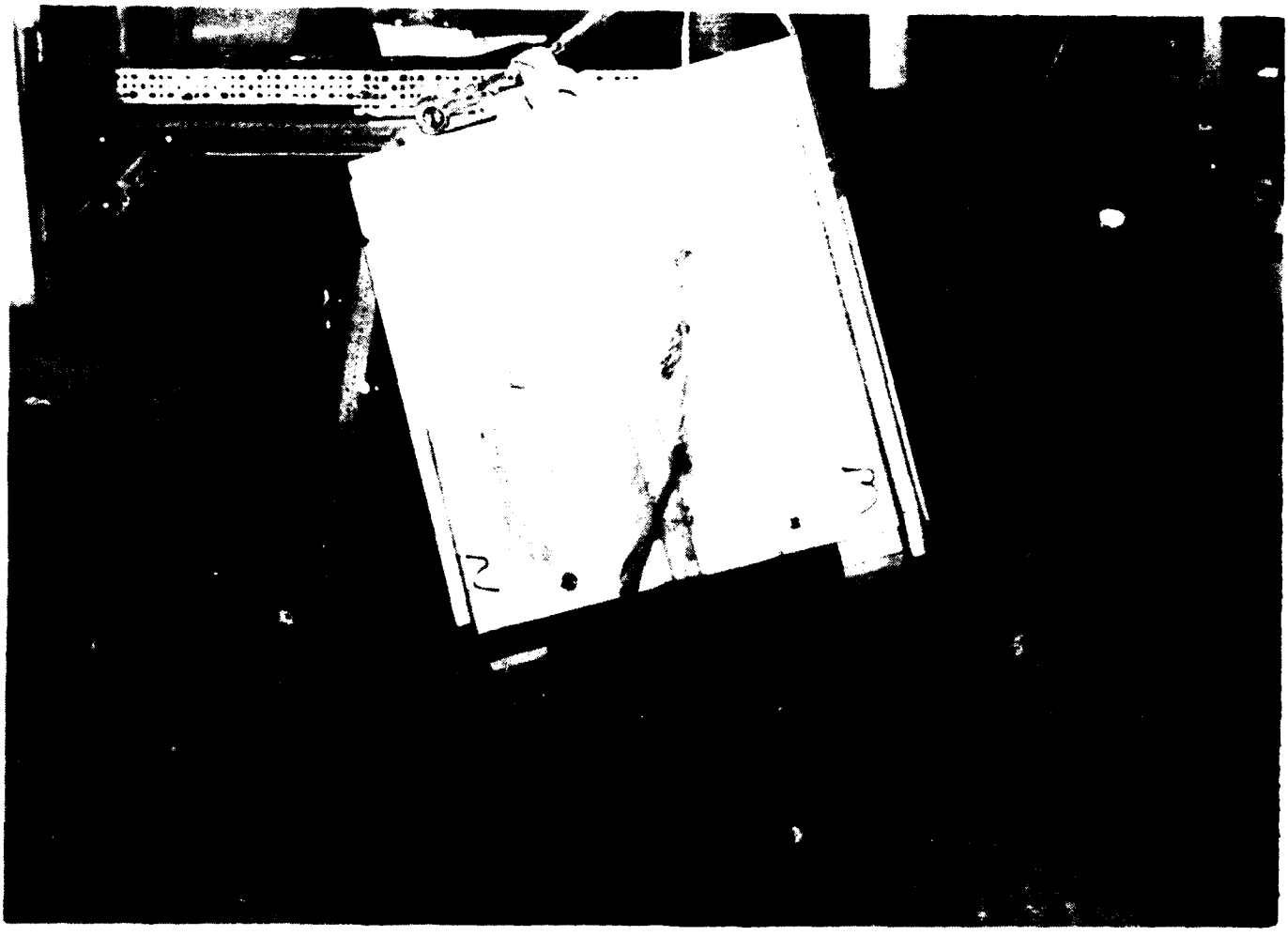

Figure 4: Cornerwise Drop - 16 inches
FTMS101C - Method 5005.1

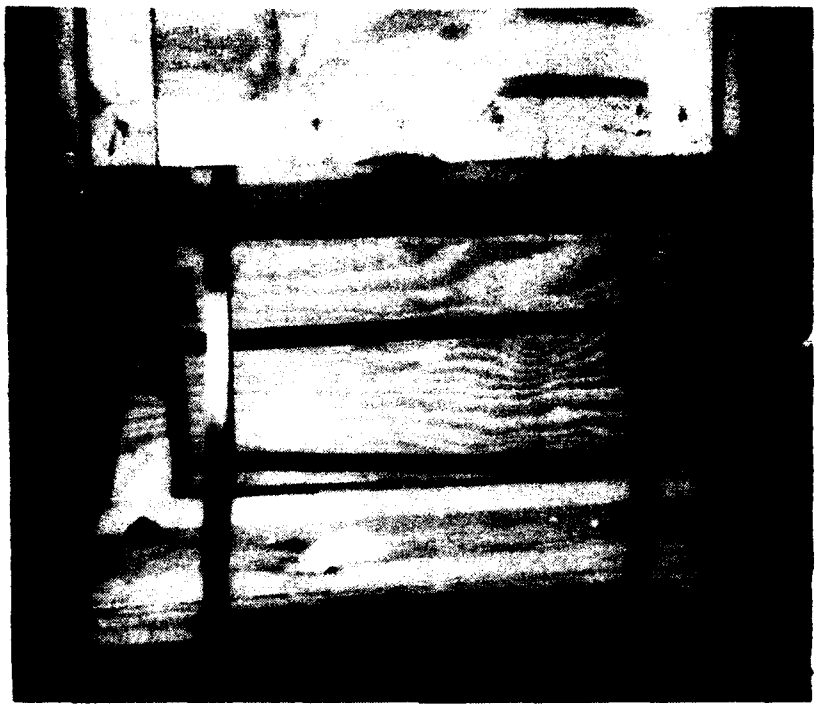

Figure 5: Container 3 - Failed Cornerwise Drop

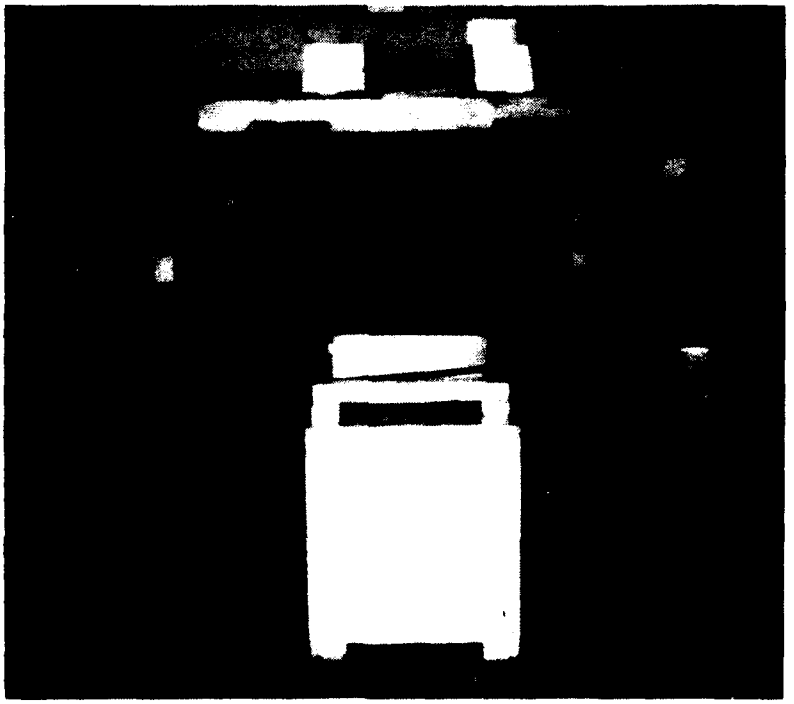

Figure 6: Superimposed Load Test - 10,500 pounds
FTMS101C - Method 5016.1

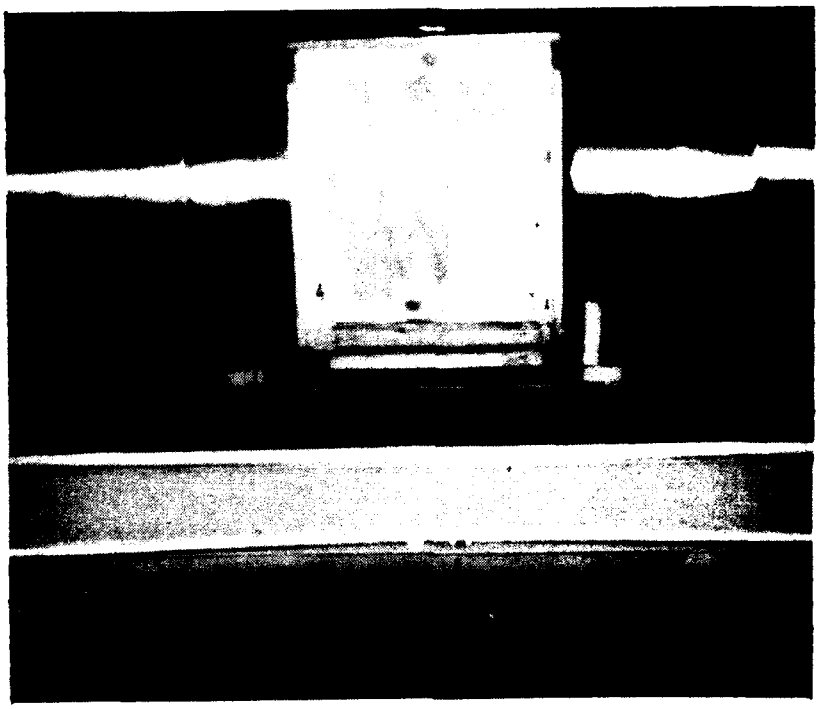

Figure 7: Repetitive Shock Test
FTMS101C - Method 5019.1

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